Data Structures I : Implementation of lists

UNIVERSIDAD EAFIT

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Cocktail of the day: Cosmopolitan

Disclaimer: Keep alcohol out of the hands of minors.

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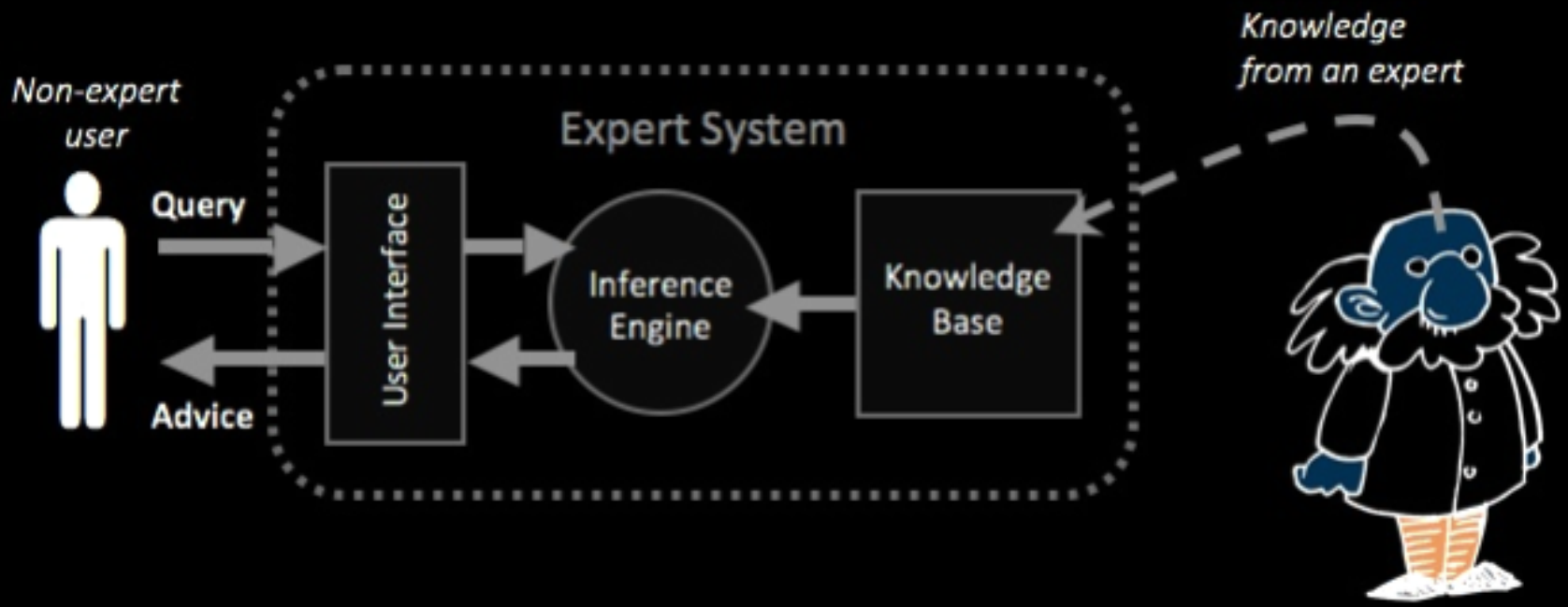
- 40 ml Vodka
- 15 ml Cointreau
- 15 ml Lime juice
- 30 ml Cranberry juice

Expert systems use trees



https://www.youtube.com/watch?v=uWEahgy3Iyc

Review: Lists

- Insertion in an array is slow ($O(n)$); insertion in a linked list is fast ($O(1)$).
- Random access in an array is fast ($O(1)$); random access in a linked list is slow ($O(n)$).
- Backward traversal of Singly-linked lists is slow ($O(n^2)$); for Doubly-linked lists and arrays is fast ($O(n)$).

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Beware of references!

Binky pointer fun!
`http://www.cs.stanford.edu/cslibrary/PointerFunJavaBig.avi`

Implementation of Links for Singly-linked lists

```
class Link {
  public int data; //data
  public Link next; //ref. to next link
  public Link(int data); //constructor
}
```

Taken from [Lof98].

Implementation of Singly-linked lists

```
class LinkedList
{
private Link first;
public void LinkedList(); // constructor
public void insertFirst(int data);
...
}
```

Taken from [Laf98].

Methods for class Singly-linked List

1. int size()
2. void insertFirst(int data)
3. void deleteFirst()
4. void deleteLast()
5. void insertLast(int data)
6. boolean contains(int data)
7. int get(int index)...

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Linked lists

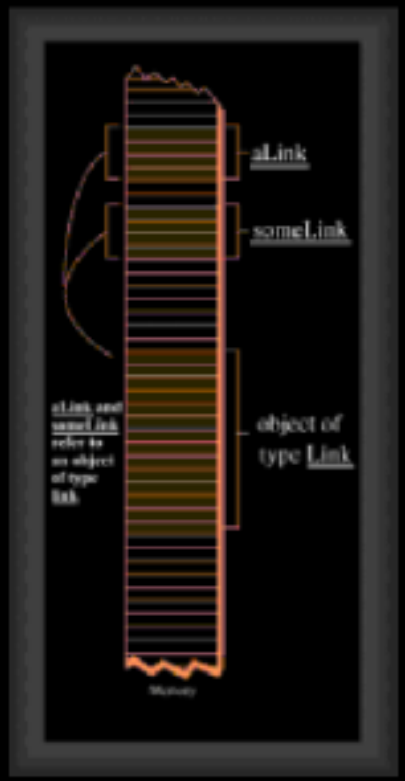

Figure: Links and references in memory. Taken from [Laf98].

Insert a new link

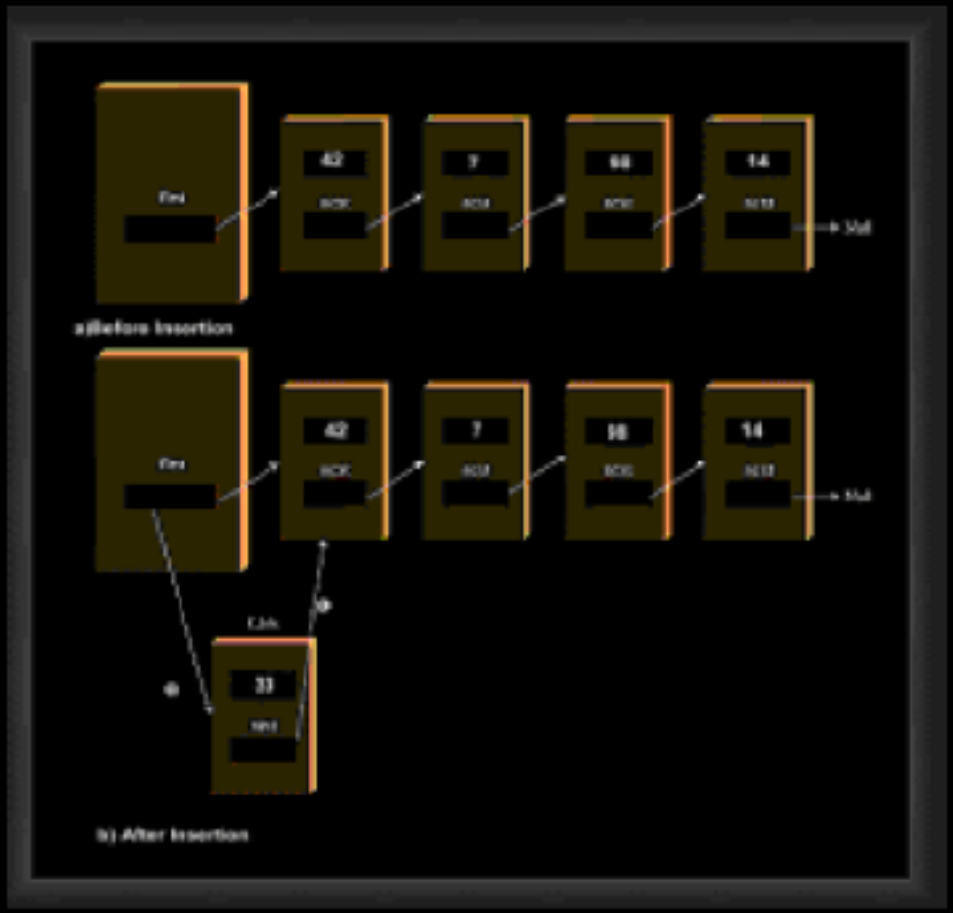

Figure: Inserting a new link. Taken from [Laf98].

Delete a link

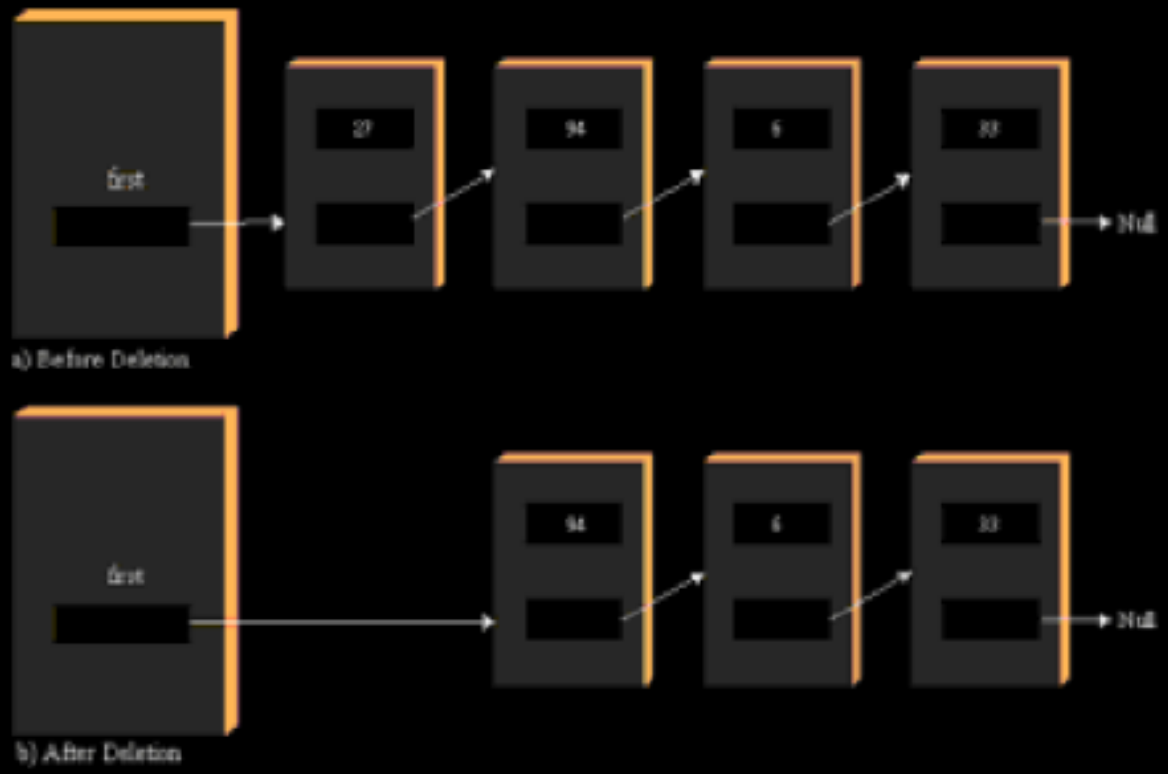

Figure: Deleting a link. Taken from [Laf98].

Simulator of a Linked list

http://visualgo.net/list.html

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Taken from [Laf98].

Implementation of Array Lists

```
class ArrayList
{
private int index;
private int[] data;
public void ArrayList(); // constructor
public void insertFirst(int data);
...
}
```

Methods for class ArrayList

1. int size()
2. void insertFirst(int data)
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4. void deleteLast()
5. void insertLast(int data)
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ArrayList

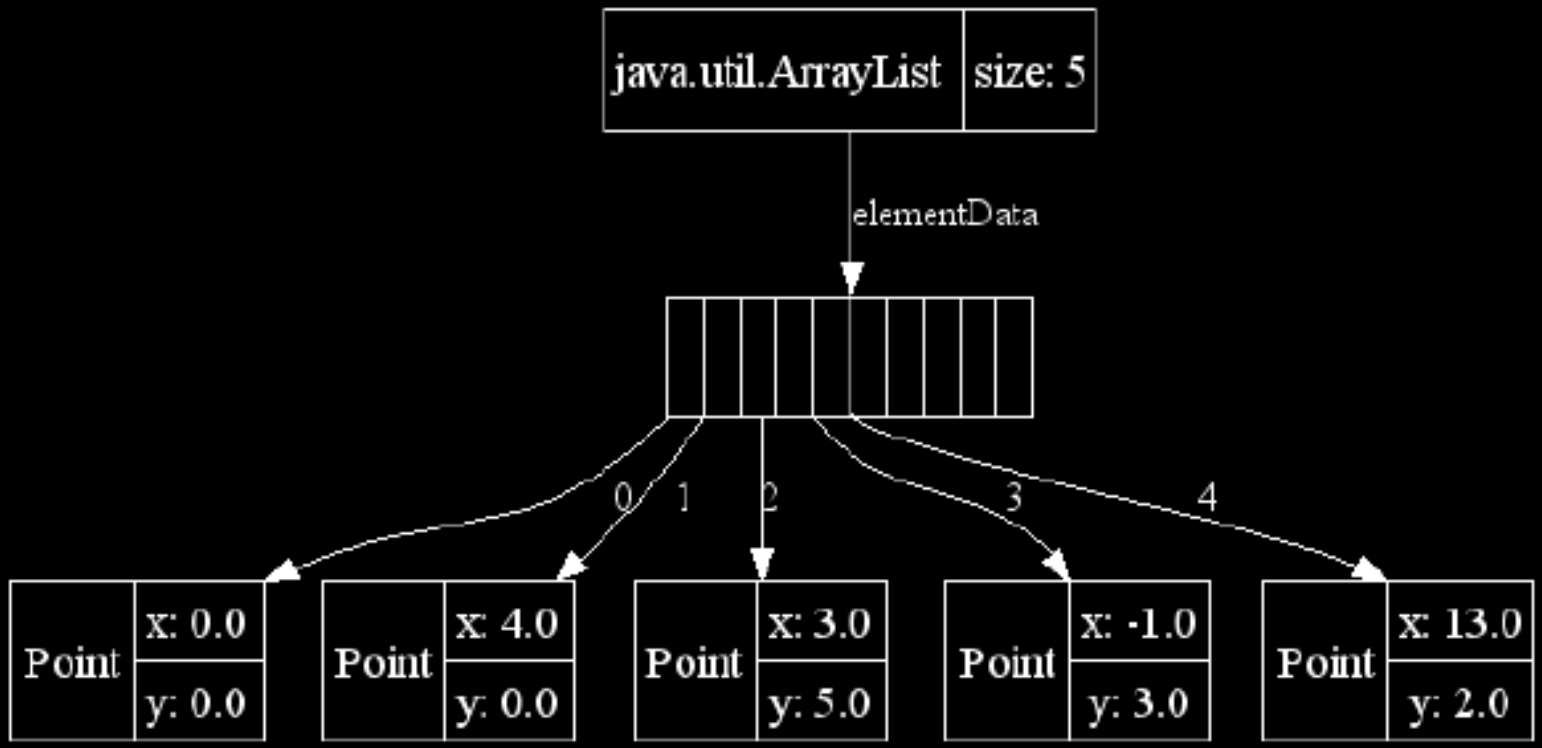

Figure: Representation of an ArrayList. Taken from `http://2.bp.blogspot.com/`

ArrayList's operations

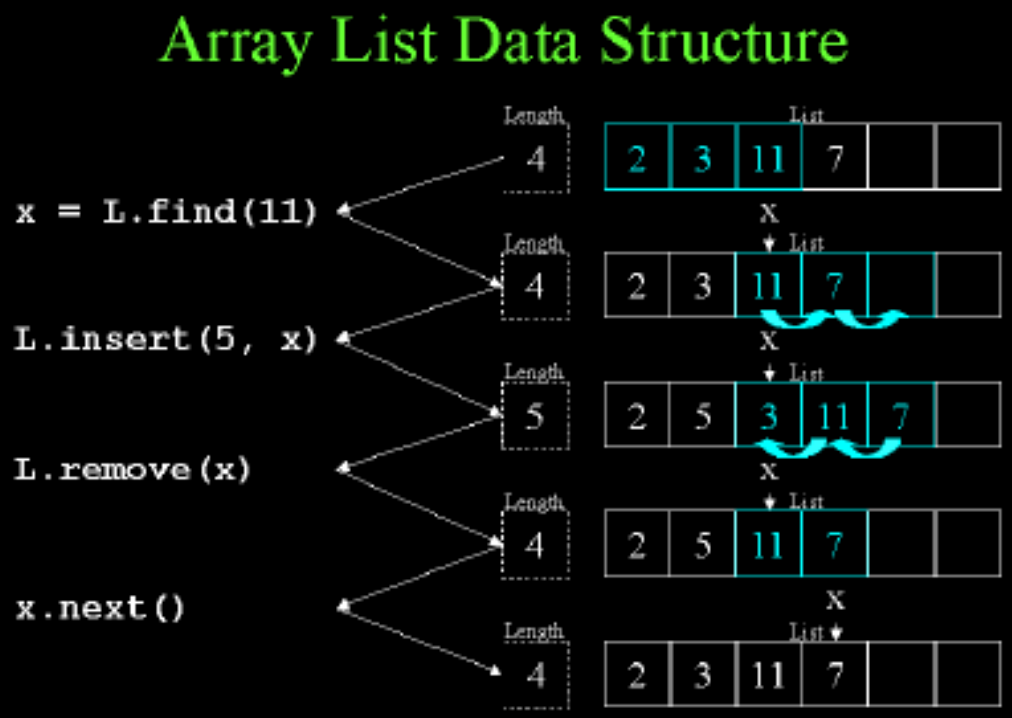

Figure: ArrayList's operations. Taken from `http://courses.cs.washington.edu/`.

Applet to simulate an Array list

http://www.cs.armstrong.edu/liang/animation/web/ArrayList.html

Methods for class ArrayList

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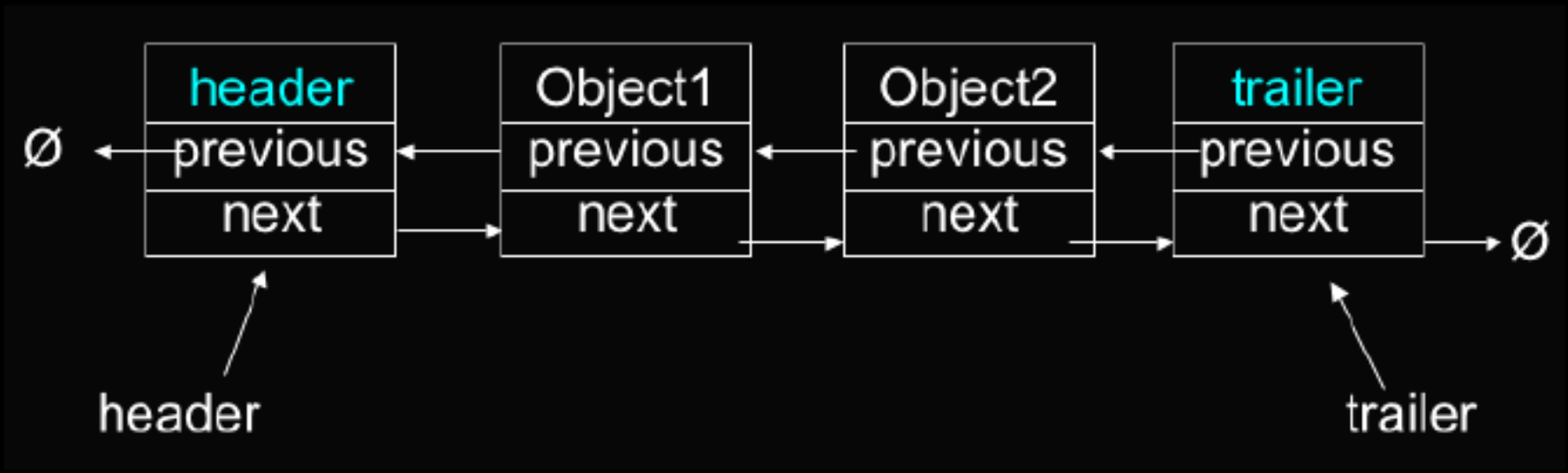
Complexity analysis

	insertFirst	insert(i)	deleteFirst	delete(i)	get(i)
ArrayList	O(n)	O(n)	O(n)	O(n)	O(1)
LinkedList	O(1)	O(n)	O(1)	O(n)	O(n)

Table: Complexity analysis of the operations of LinkedList and ArrayList.

Implementation of Doubly-linked Lists



For more details, please check

- Robert Lafore. Data Structures and Algorithms in Java. Chapter 5.

Quiz questions

- Methods for both Linked List and Array List are the same, but implementations are different.
- Linked List is more efficient for insertion and ArrayList is more efficient for random access.

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References

- Please learn how to reference images, trademarks, videos and fragments of code.
- Avoid plagiarism

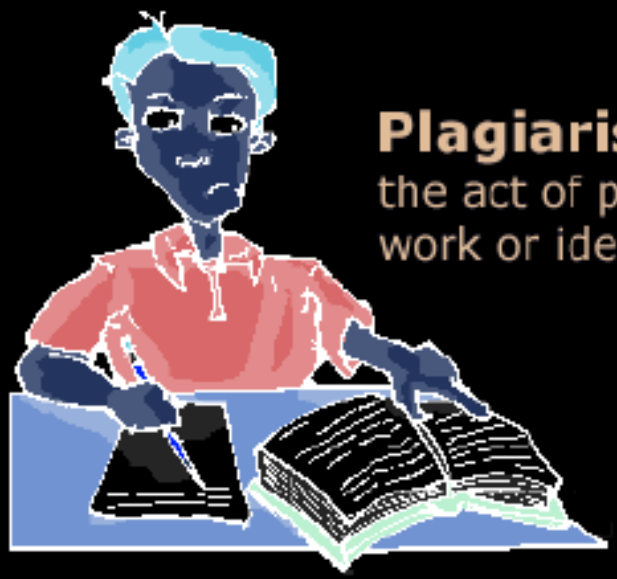

Figure: Figure about plagiarism, University of Malta [Uni09]

References

Robert Lafore.

Data Structures and Algorithms in Java.

QUE; 1 edition (8 November 2002), 1998.

University of Malta.

Plagarism — The act of presenting another's work or ideas as your own, 2009.

[Online; accessed 29-November-2013].

Further reading

- Linked Lists
  - Robert Lafore. Data Structures and Algorithms in Java. Chapter 3.